

PRIMARY URETHRAL CALCULUS.¹

WITH REPORT OF A CASE.

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ON account of the rarity and size of the calculus found in the urethra and the absence of symptoms, the following case is thought worthy of reporting.

Abstract from Clinical History.—The patient, male, aged fifty years, works in dyes used in staining tanned hides; no previous illness except gonorrhœa twenty years ago; denies syphilis or its symptoms; uses alcoholic beverages freely. When admitted to the Cook County Hospital, service of Dr. Sherwood, April 8, 1904, he had a marked cirrhosis of the liver, and cellulitis of the leg following a slight injury. Two specimens of urine were examined and found clear, amber colored, distinctly acid, no sediment; the first having no albumen and the second only a trace. Blood count showed leucocytosis of 12,000. After running a septic course, death occurred April 19, 1904.

Anatomic Diagnosis (Dr. Stober).—Suppurative cellulitis of the leg; syphilitic cirrhosis of the liver; chronic nephritis; chronic hyperplastic splenitis; varicose veins of the œsophagus and abdomen; ascites; passive hyperæmia of the viscera; sclerosis of the aorta; obliterative fibrous pleuritis of the right side; hyperplasia of the tracheobronchial lymph glands with calcification; multiple calculi in the urethra.

The serious septic condition of the patient and the total absence of symptoms pointing to the involvement of the genito-urinary tract caused the calculus to be overlooked during the life of the patient. The calculus weighs 23.62 grammes, is some-

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FIG. 1.—Penis and urethra split ventrally. Arrow at left of figure shows direction of urinary current. *a*, larger mass of the calculus; *b*, posterior protrusion joining larger mass by narrow neck, *c*.



FIG. 2.—Longitudinal section of the calculus showing the egg-shaped nucleus (*a*) with the empty cavity at its anterior end, and also showing concentric arrangement of the layers in both the main body (*a*) and the posterior protrusion (*b*); *c* shows portion lodged in the diverticulum on the dorsal side of the penis; and *e*, the narrow constriction at the posterior brim of the diverticulum.

what irregular in contour, and appears to be made up of two ovoid constituents fused together as they lay in contact by the deposition of urinary salts. The dimensions of the larger mass ((a) Fig. 1) are, length three, width 2.4, thickness 3.3 centimetres. To this is added posteriorly another part ((b) Fig. 1), joining the former by a slightly narrowed neck ((c) Fig. 1). This is ovoid in shape and measures 1.6 centimetres in length and 1.2 centimetres at its greatest diameter. The greater part of the surface is smooth and of a yellowish brown color, notably the upper surface, which in reality forms the floor of the urethra, while the portion measuring two by three centimetres, lying in a distinct diverticulum, is gently faceted, owing to the presence of 130 or more small millet-seed sized, grayish concretions which stud the lining of the sac, and is of a dirty gray color.

On section longitudinally, the calculus is found to be composed of easily discernible concentric layers, either complete or crescentric, deposited about a prominent nucleus ((b) Fig. 2), which is about the size of a sparrow's egg and bears marked resemblance to the same in shape, lying with its small end in the direction of the urinary current, as indicated by the arrow in Fig. 1. The nucleus has in itself a pea-sized cavity (Fig. 2) containing a small amount of phosphatic debris. It may be readily inferred that this cavity was originally a mass of organic matter consisting of blood, pus, or some other inflammatory product, resulting from the patient's early gonorrhœa or some trauma; forming the nucleus for the future deposit, and as the inorganic salts were deposited as a thin shell, the organic matter was broken down and removed by a process of osmosis leaving an empty cavity. Posteriorly this cavity is bounded by three well-marked crescentric layers of considerable density, each crescent increasing in extent towards the periphery. About these and forming the only wall at the anterior end of the cavity is a layer approximately only one millimetre thick, constituting, as it were, a shell for the egg-shaped nucleus. This egg-shaped mass lies at the anterior end of the whole calculus, and has about itself a grayish loose layer, thickest posteriorly. Upon this follow a number of yellowish brown crescentric layers, also increasing in extent outward and of considerable density. These crescents are small where the calculus reaches the posterior brim of the diverticulum and make up the bulk of this posterior protrusion ((b)

Fig. 2). Surrounding the mass, except at its most anterior point, is a grayish zone, soft and granular; and this is covered by the outermost layer, complete, one millimetre thick, hard, brittle, and only loosely cemented to the preceding layer.

As to its relation to the urethra, the calculus occurred in the pars pendula of the penis; its foremost point being 5.4 centimetres posterior to the meatus urinarius externus, while the rear portion is ten centimetres distant from the same point. The anterior inferior portion ((e) Fig. 2) is lodged in a diverticulum lying in the median dorsal surface of the urethra. This pocket, or diverticulum, closely fits about its contents, but evidently has permitted of some motion of the same, as deposition has occurred uniformly on this included surface as well as on the free surface of the calculus. The wall of this sac is made up of all the normal coats of the urethra, including the mucosa. It is slightly thickened with some preponderance of fibrous tissue, especially at the anterior portion. The remainder of this calculus encroaches upon the lumen of the urethra, converting the same into a crescentic slit for the extent of itself, but evidently not interfering with the passage of urine.

After a thorough investigation of the literature, Professor Englisch, of Vienna, has collected 405 cases of urethral calculi, and classifies them as to age and localization as shown in Table I, and composition, as shown in Table II.

In the accompanying Table I, given by Englisch, it is evident that the number of cases of urethral calculi increases decidedly as the upper portions of the urethral tract are approached,—there being 41 cases in the fossa navicularis; 53 in the pars pendula; 50 in the pars scrotalis; 68 in the pars bulbosa; and 149 in the pars membranica. This division into these respective parts is based upon certain normal anatomic peculiarities which figure in the lodgement and formation of urethral calculi and depends upon the following characteristics. The external urinary meatus is the narrowest portion of the urethra, and has back of it an expansion, the fossa navicularis, which terminates posteriorly by a narrowed communication leading to the pars pendula. Anteriorly the bulbous urethra has a nar-

TABLE I. (ENGLISCH).

Age.	Number.	Fossa Navicularis.	Pars Pendula.	Pars Scrotalis.	Pars Bulbosa.	Pars Membranica.	Undetermined.
1	5	1	2	1	0	1	0
2	23	2	1	6	4	7	3
3	6	2	1	2	1	0	0
4	14	7	1	1	1	4	0
5	6	1	2	0	1	1	1
6	12	1	3	2	1	3	2
7	5	1	0	1	0	2	1
8	4	1	1	0	1	1	0
9	7	1	1	1	2	2	0
10	10	1	1	0	4	3	1
11-15	35	4	1	5	7	17	1
16-20	22	2	4	4	2	6	4
21-25	26	3	2	3	2	16	0
26-30	15	4	2	2	0	7	0
31-35	15	0	1	1	4	8	1
36-40	24	2	3	5	5	5	4
41-45	23	2	3	1	4	11	2
46-50	27	0	6	2	8	8	3
51-55	11	1	0	2	2	5	1
56-60	12	0	0	2	2	8	0
61-65	3	0	0	1	0	2	0
66-70	13	0	5	1	1	5	1
71-75	4	0	0	2	0	2	0
76-80	2	0	0	0	0	1	1
Undetermined	81	15	13	5	16	24	18

TABLE II. (ENGLISCH).

	Urates.	Oxalates.	Phosphates.	Urophosphates.	Oxalat. Phosphates.	Kohlen. Phosphate Kalk.
Fossa Navicularis . . .	3	4	2	1	1	0
Pars Pendula	5	2	6	6	1	2
Pars Scrotalis	5	1	5	4	0	0
Pars Bulbosa	2	6	4	2	0	1
Pars Membranica	4	2	9	4	4	1
Undetermined	2	1	1	2	1	0
Total	21	16	27	19	7	4

rowed outlet, while posteriorly the transition is effected through the resistant anterior leaflet of the triangular ligament into the pars membranica, which has a corrugated surface and is easily distensible. Thus we have a constriction or resistance and a distended or distensible portion posterior to it, where any object

passing along the urethra may be arrested, and yet not completely occlude the canal. Under such occasions there may be a ball-valve action of the calculus, a phenomenon well illustrated by some of the reported cases, and also in another case which came under my observation recently, where the calculus had passed all obstructions down to the fossa navicularis, causing partial obstruction at intervals, until, at the external meatus, occlusion became complete and could only be removed by surgical means. Besides these physiologic anatomic conditions, we have certain pathologic ones which play even greater part in securing lodgement or aid in the formation, *in situ*, of such calculi, and will be discussed later.

As to age, Table I shows that, although distributed over four-fifths of the century at certain periods, we have increased prevalence. Especially early, at about the second year, the number of cases is high, perhaps due to congenital narrowness of the urethra. Again, from the eleventh to the fifteenth year, during adolescence, where we may assume, according to Englisch, that the hyperæmia incident to puberty is a factor. Another favorable period is early manhood, when inflammatory reactions, gonorrhœal or traumatic, are prone to occur and constitute some organic obstruction or form material for an organic nucleus for future deposit, while between thirty-five and fifty strictures resulting from such inflammations play an important part.

The chemical composition has also been studied in ninety-four of the reported cases and judged to be as given in Table II. In the case under discussion, a complete chemical analysis was made, and the calculus was found to be purely phosphatic, with a minimum amount of organic material. (Analysis of the different layers being made separately.)

Although but few cases have been reported where the higher urinary passages showed an associated condition, Kaufmann and Englisch hold that calculi retained in the urethra are usually secondary, having been preformed at higher levels and arrested in their passage, but they may be greatly modified after having become lodged. This may be true where the urethra is

normal and perhaps with urate and oxalate calculi, yet there are cases where the primary origin in the urethra seems undoubted, especially where there coexists dilatations or diverticulæ of considerable size, where urinary stasis can take place, similar to that in the pelvis of the kidney or in the bladder. Such diverticulæ can originate in various ways and may be true, containing all the coats of the normal urethra, or false, being a sac communicating with the urethra, but containing none or only parts of the coats, although often lined with a membrane which closely resembles the normal mucosa. True diverticulæ may be primary, and, as such, may be congenital or acquired. The congenital forms may arise in various ways, namely, (1) failure of the genital folds to unite for their entire extent, thus leaving fissures or pockets; (2) agglutination of the urethral surfaces at the narrowest parts above mentioned during the first few months of intra-uterine life and a resulting dilatation posterior to the same; (3) congenital strictures or valves may cause a similar result. As previously stated, true diverticulæ may also be secondary or acquired, and then usually follow strictures of inflammatory origin, mainly gonorrhœal, but occasionally traumatic. More rarely they follow lodgement of a calculus in a normal urethra, with accompanying pressure atrophy and absorption of the surrounding tissue. False diverticulæ, the anatomy of which has already been alluded to, are cavities communicating with the urethra following periurethral abscess (Kaufmann), or rupture of the urethra with urinary infiltration and resulting breaking down of the tissues involved (Englisch). Occasionally we have a pocket formed in the pars bulbosa by a distention of Cowper's glands with inflammatory products (Englisch).

In the case under discussion we have evidently one of primary urethral calculus. The sac is that of a true diverticulum in structure; whether congenital or acquired late in life cannot be demonstrated, but evidence is in favor of the former, as no organic stricture can be detected anterior to the same. The nucleus of organic matter is readily explained by the early gonorrhœa, with, perhaps, injections as treatment. This nucleus,

floating anteriorly, as far as possible, had added to it, mainly posteriorly, layer after layer of phosphatic deposit until the present dimensions have been reached, the smaller concretions forming between it and the wall of the sac as the calculus became less mobile. The urine showed marked acidity, and, as the patient was suffering from cirrhosis of the liver, for that time has probably been acid, favoring deposits of oxalates and urates instead of phosphates (Purdy). Therefore the entire concretion has presumably antedated this malady. It may, however, have occurred at a period when the urine was alkaline from a complicating cystitis, during periods of phosphaturia, or, perhaps, the alkaline tide, the alkalinity after meals being sufficient to secure phosphatic deposit which the acidity of the interim was unable to dissolve.

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